

**PARLIAMENT OF INDIA**  
**(JOINT RECRUITMENT CELL)**

MAIN EXAMINATION FOR THE POST OF SECURITY ASSISTANT GRADE-II (TECHNICAL) IN LOK SABHA SECRETARIAT

24<sup>th</sup> JUNE, 2014

**PAPER-I: GENERAL STUDIES**

**INSTRUCTION : All answers must be written in only one stream i.e. English or Hindi.**

Time : 2 hours

Marks : 100

1. Answer any ten of the following in about 30 words each: (2x10=20 Marks)
- |                                |                            |                        |
|--------------------------------|----------------------------|------------------------|
| (i) MH370                      | (ii) Private Member's Bill | (iii) Saptapadi        |
| (iv) Protective Discrimination | (v) KHAPS                  | (vi) Nifty             |
| (vii) 'Dandia'                 | (viii) World Bank          | (ix) LOC               |
| (x) EVMs                       | (xi) Akash Missile         | (xii) Forex (xiii) FDI |
2. Answer any one of the following in about 150 words. (10 marks)
- What are the regulations and governing laws in India for funding of Political Parties?
- or
- What are the guidelines of 'The National Commission for Protection of Child Rights'? Describe.
3. Answer any one of the following in about 150 words: (10 marks)
- Ethics is the cornerstone of effective, efficient and democratic governance. Comment.
- or
- Do you think ethical performance of an employee can be evaluated fairly and accurately? Yes/No. Justify your answer.
4. Answer any one of the following in about 150 words: (10 marks)
- Who gave the slogan 'Jai Jawan, Jai Kisan'? Discuss the significance of this slogan.
- or
- Discuss the objectives of Bhoodan and Gramdan movements initiated by Achaarya Vinoba Bhave and their success.
5. Answer any one of the following in about 300 words: (20 marks)
- Discuss the various social problems which originated as a result of speedy process of urbanisation in India.
- or
- Growing feeling of regionalism is an important factor in the generation of demand for separate States. Discuss.
6. Answer any one of the following in about 150 words: (10 marks)
- A cyclone on the east coast of India was called 'PHAILIN'. How are the tropical cyclones named across the world?
- or
- Describe the causes that are responsible for more frequent landslides in the Himalayas than in Western Ghats.
7. Answer any five of the following in about 30 words each: (2x5=10 Marks)
- |               |                   |                          |                              |
|---------------|-------------------|--------------------------|------------------------------|
| (i) Wikipedia | (ii) VIRUS        | (iii) Piracy             | (iv) Artificial Intelligence |
| (v) Firewall  | (vi) Cyber Crimes | (vii) Digital Signatures |                              |
8. Answer any one of the following in about 150 words: (10 marks)
- What is 'water harvesting'? Describe its relevance in Indian context.
- or
- Describe the effects of 'Global Warming'.
- or
- What is 'biodiversity'? Examine the causes and consequences of biodiversity.

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**PAPER-II: MATHEMATICS AND SCIENCE**

**INSTRUCTIONS : Attempt six questions in all with two questions from each section.**

**Time: 2 hours**

**Marks: 100**

**SECTION- A**

**PHYSICS**

**40 Marks**

**Note: Attempt any two questions from this section.**

- Q.1 a) Explain virtual ground concept in case of operational amplifier. (5)  
b) Design and draw the circuits of voltage amplifiers using op-amp to obtain the following gains (i) -10; and (ii) +5. (6+4)  
c) Explain the terms (i) CMRR and (ii) slew rate of an op-amp. (2+3)
- Q.2 a) Explain the working of p-n junction diode as rectifier. (10)  
b) Describe the effect of bias voltage on the depletion layer at the junction. (10)
- Q.3 Explain with example following bonds in solids:  
(i) ionic bond; (ii) covalent bond; (iii) hydrogen bond; and (iv) metallic bond. (4X5)
- Q.4 a) Write the thermodynamic definition of Temperature. Explain any two methods of attaining ultra low temperatures. (10)  
b) Explain the mechanism of conduction in high temperature superconductors. (10)

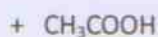
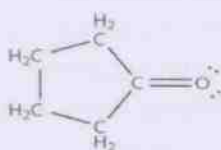
**SECTION- B**

**CHEMISTRY**

**30 Marks**

**Note: Attempt any two questions from this section.**

- Q. 5 a) Calculate the ratio of effusion rate of hydrogen to oxygen. (2½)  
b) What are extrinsic and intrinsic semiconductors? Give the reasons for their conductivity. (2½)  
c) An alkene on treatment with ozone followed by aqueous H<sub>2</sub>O<sub>2</sub> gave the following products: (2½)

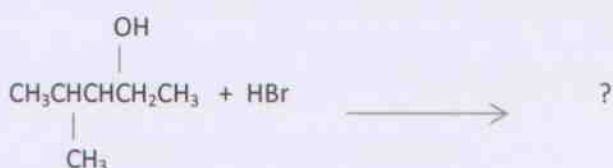


What is the structure of the alkene?

- d) Draw the enantiomers of 2-butanol. Identify the chiral centre present in it. (2½)

- e) Giving an example, explain the Mond's process of purification of metals. (2½)
- f) Which of the complexes  $K_2[NiCl_4]$  and  $K_2[Ni(CN)_4]$  has a square planar structure? Explain on the basis of Crystal Field Theory. The atomic number of Ni is 28. (2½)

- Q.6 a) The enthalpy of combustion for methanol at 298.15 K is  $-726.1 \text{ kJ mol}^{-1}$ . Calculate its enthalpy of formation, if  
 $\Delta_f H^0(\text{CO}_2) = -393.5 \text{ kJ mol}^{-1}$  and  $\Delta_f H^0(\text{H}_2\text{O}) = -285.8 \text{ kJ mol}^{-1}$  (2½)
- b) Calculate the osmotic pressure of an aqueous solution containing 19.0 kg of sucrose (molar mass  $0.342 \text{ kg mol}^{-1}$ ) in  $1.00 \text{ m}^3$  of the solution at 300K. (2½)
- c) Draw the boat and chair conformations of cyclohexane. Which one of the two is more stable and why? (2½)
- d) Write the main product formed in the following reaction: (2½)



Give reasons in support of your answer.

- e) Explain the difference between electronegativity and electron affinity. (2½)
- f) Explain the splitting of  $d$ - orbitals of a  $d^6$  transition metal  $M^{2+}$  ion in a tetrahedral crystal field. (2½)
- Q.7 a) If the synthesis of ammonia from nitrogen and hydrogen is an exothermic reaction, what will be the effect of (i) increase in pressure and (ii) decrease in temperature on the reaction equilibrium. (2½)
- b) The solubility of AgCl is  $1.37 \times 10^{-5} \text{ M}$  at 298K. Calculate the solubility product of AgCl. (2½)
- c) Why is TMS chosen as a standard in recording the  $^1\text{H-NMR}$  spectrum? (2½)
- d) Write all the products of nitration of acetanilide. Which one of them is the major product? What type of reaction is this? (2½)
- e) What are electron deficient compounds? Give an example of the same. (2½)
- f) What are transition and inner- transition elements? Explain the difference between the two. (2½)
- Q.8 a) The first order rate constant for the decomposition of  $\text{N}_2\text{O}_5$  at 340K is  $5.20 \times 10^{-3} \text{ s}^{-1}$ . What will be the time required for this concentration to fall to (i) one-half, and (b) one-eighth of its initial value? (2½)
- b) Explain the following terms: (2½)
- i) Brownian motion                      ii) Tyndall effect
- c) How will you obtain *trans*-2-butenal using aldol condensation? Write the reaction giving the reaction conditions. (2½)
- d) Give the structures of the monomers used for synthesizing the following: (2½)
- i) Bakelite                                      ii) PET
- e) What are polymers? Give one example each of a linear and a cross linked silicone polymer. (2½)
- f) Give one example each of only a  $\sigma$ - donor ligand, both a  $\sigma$ -donor and  $\pi$ -donor ligand, and a  $\sigma$ - donor and a  $\pi$ - acceptor ligand. (2½)

## SECTION -C

## MATHEMATICS

30 Marks

Note: Attempt any two questions from this section.

- Q.9) a) State De Moivre's theorem. Use it to expand  $\cos 4\theta$  in powers of  $\cos \theta$ . (4)
- b) Find a fourth degree polynomial with rational coefficients having  $\sqrt{3} + \sqrt{5}$  as a root. (3)
- c) Find the point on the parabola  $y^2 = x$  which is closest to the point  $(0,2)$ . (4)
- d) Prove by mathematical induction that  $2^n > n$  for all  $n \geq 1$ . (4)
- Q.10) a) Show that  $\begin{vmatrix} a & b & c \\ b+c & c+a & a+b \\ a^2 & b^2 & c^2 \end{vmatrix} = -(a-b)(b-c)(c-a)(a+b+c)$ . (5)
- b) Prove that there are two planes that pass through the line  $x + y = 1, z = 0$  and make an angle  $\sin^{-1} \frac{1}{3}$  with the plane  $x + y + z = 0$ . Also, find the equation of the planes. (5)
- c) Find the characteristic polynomial of the matrix  
 $A = \begin{pmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 1 & 2 \end{pmatrix}$ . Verify Cayley-Hamilton theorem for  $A$ . Also, find the inverse of  $A$  using Cayley-Hamilton theorem. (5)
- Q.11) a) Change the order of integration in the following integral and evaluate it:  
 $\int_0^{4a} \int_{x^2/4a}^{2\sqrt{ax}} dy dx$ . (5)
- b) Test the convergence of the following series:  
 i)  $\frac{1}{\sqrt{2+\sqrt{3}}} + \frac{1}{\sqrt{3+\sqrt{4}}} + \frac{1}{\sqrt{4+\sqrt{5}}} + \dots$  ii)  $\sum_{n=1}^{\infty} \frac{n^2+a}{2^{n+a}}$  (5)
- c) Solve the differential equation  $(D^3 - 6D^2 + 11D - 6)y = e^{-2x} + e^{-3x}$  (5)
- Q.12) a) Solve the equation  $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} = \sin x \cos 2y$ . (5)
- b) Find the image of the infinite strip  $\frac{1}{9} \leq y \leq \frac{1}{3}$  under the transformation  $w = \frac{1}{z}$ . Also show the regions graphically. (5)
- c) Out of 800 families with 4 children each, how many families are expected to have (5)  
 i) 2 boys and 2 girls. ii) At least one boy.  
 iii) No boy. iv) At most two girls.  
 Assume equal probabilities for boys and girls.